

Possible
Deletion

R88-411

240-245	.021
245-250	.020
375-380	.024
380-385	.020
395-400	.023
700-705	.021
875-880	.022

} 7

R88-412

85-90	.021
95-100	.023
110-115	.022
275-280	.023
505-510	.022
530-535	.021
635-640	.021
940-945	.022
1070-1075	.025

★

R88-413

450-455	.020
455-460	.020
475-480	.022
500-510	.023
640-645	.023
645-650	.021
735-740	.021
740-745	.020
870-875	.022
965-970	.021

R88-416

85-90	.024
145-150	.024
250-255	.020
315-320	.022
350-355	.020
425-430	.020
535-540	.024
625-630	.023
720-725	.023
915-920	.020
1005-1010	.021
1180-1185	.023

R88-423

280-285	.023
420-425	.025
490-495	.022
505-510	.022
660-665	.021
755-760	.020

ok-get

R88-424

375-380	.024
825-830	.023
840-845	.020
915-920	
920-925	.021
1035-1040	.020
1160-1165	.020
1300-1305	.020

R88-427

925-930	.023
990-995	.020
995-1000	.023
1010-1015	.023
1185-1190	.021

R88-429

135-140	.022
175-180	.021
245-250	.020
275-280	.022
360-365	.023
365-370	.020
375-380	.020
410-415	.020

.0217 (.022)

~~700~~

$$700^{\#} \times .022 = 15.51$$

$$568 \times .086 = 48.85$$

$$1268^{\#} \times .051 = 64.358$$

} all samples

$$\left[\begin{array}{l} 527 \times .059 = 31.093 \\ 700 \times .022 = 15.51 \\ 1227 \times .038 = 46.603 \end{array} \right] \begin{array}{l} \leq .25 \\ \text{All 2nd Batch} \end{array}$$

Jim

BROHM MINING - SULFIDE DEVELOPMENT PROGRAM

METALLURGICAL TESTING - SCOPE OF WORK

OCTOBER 10, 1988

INTRODUCTION

Brohm Mining is in the initial stages of a large diameter core drilling program. The core will provide samples for the metallurgical testing and flowsheet confirmation. The results will form the basis of a "bankable" feasibility study which will be the responsibility of a recognized engineering firm. Brohm will select an organization to perform the metallurgical testing based on the proposals to the following overall scope of work.

IT SHOULD BE CLEARLY UNDERSTOOD THAT THE SELECTION OF TESTING ORGANIZATION WILL BE AT THE SOLE DISCRETION OF BROHM. AS TESTING RESULTS BECOME AVAILABLE THE SCOPE OF WORK WILL BECOME SUBJECT TO CHANGE; THEREFORE TESTWORK WILL BE AWARDED IN PHASES WITH A DETAILED SCOPE OF WORK AND COSTS IDENTIFIED FOR EACH SEPARATE PHASE.

TESTING SUMMARY AND SAMPLE AVAILABILITY

Table 1 summarizes the samples and the expected testwork for each sample:

TABLE 1

BROHM SULFIDE DEVELOPMENT
EXPECTED TESTWORK REQUIRED

SAMPLE DESCRIPTION	6' x 2' SAG MILL TESTING	18" SAG MILL TESTING	BENCH SCALE TESTING	CONTINUOUS PILOT TESTING
Trachyte Porphyry	no	yes	yes	no
Trachyte Breccia	no	yes	yes	no
Precambrian	no	yes	yes	no
Trachyte Composite 65 % trachyte porphyry 35 % trachyte breccia	yes	yes	yes	yes
Variability Samples (20)	no	no	yes	no

BROHM SULFIDE DEVELOPMENT
SAMPLE AVAILABILITY
(POUNDS OF SAMPLE)

Trachyte Porphyry	22,000
Trachyte Breccia	12,000
Precambrian	1,000
Variability Samples (20)	1,500 (20 @ 75 pounds each)

SAMPLE PREPARATION

All samples for the metallurgical testing program will be taken from 6 inch diameter drill core. The laboratory will receive the uncrushed 6 inch core in individual intervals of approximately 2.5 feet. The core is generally expected to be competent and single pieces of core of 2 to 2.5 feet in length are probable. Each individual interval will weigh approximately 75 pounds.

Flowsheets 1 to 4 generally outline the sample preparation proposed for the metallurgical testing program.

FLOWSHEET 1
SAMPLE PREPARATION FOR 6' x 2'
SAG MILL TESTING.

DRILL CORE INTERVALS (APPROXIMATELY 140 @
75 POUNDS EACH)

↓
CRUSH TO MINUS 6 INCH.

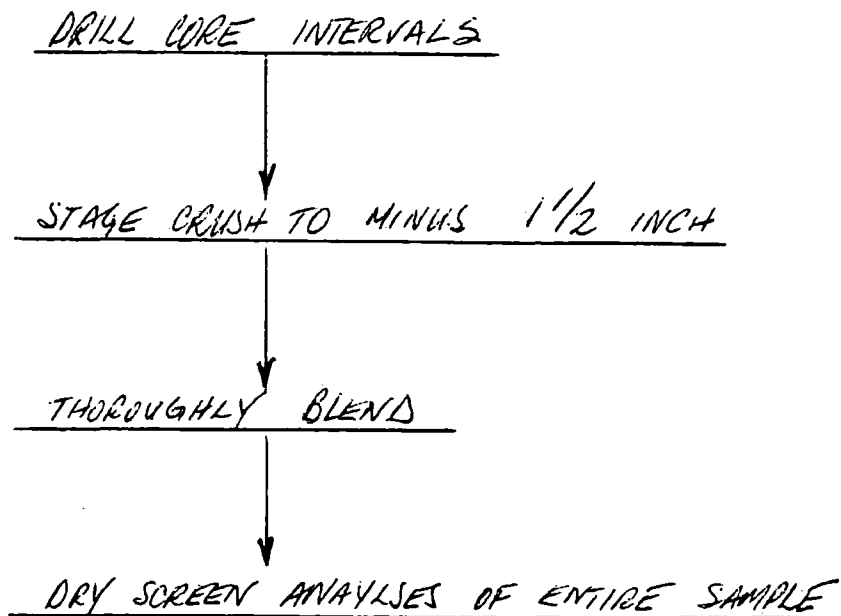
↓
THOROUGHLY BLEND

↓
DRY SCREEN ANALYSES OF
ENTIRE SAMPLE

-6" + 4"
-4" + 2"
-2" + 1"
-1" + 1/2"
-1/2" + 1/4"
-1/4"

SAMPLE WILL BE STORED AS INDIVIDUAL FRACTIONS
FOR SAG MILL TEST.

FLOWSHEET 2
SAMPLE PREPARATION FOR 18"
SAG MILL TESTING



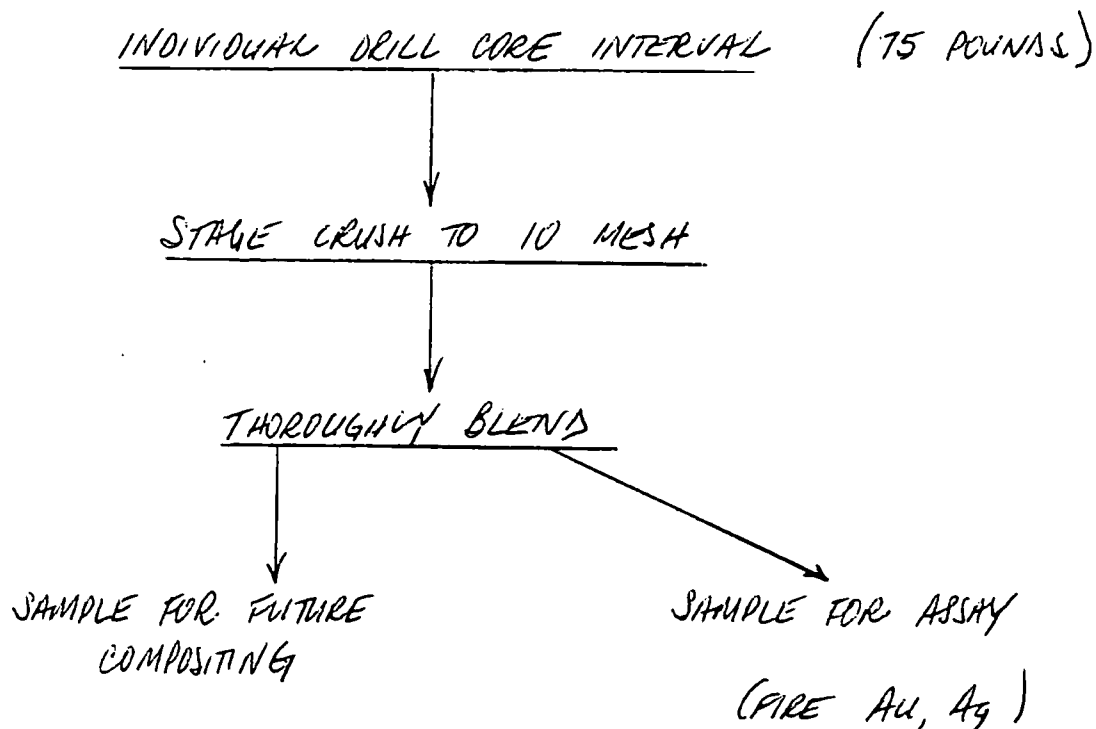
- 2" + 1"
- 1" + 3/4"
- 3/4" + 1/2"
- 1/2" + 1/4"
- 1/4" + 10 MESH
- 10 MESH.

NOTES:

4 SEPARATE SAMPLES EACH CONTAINING

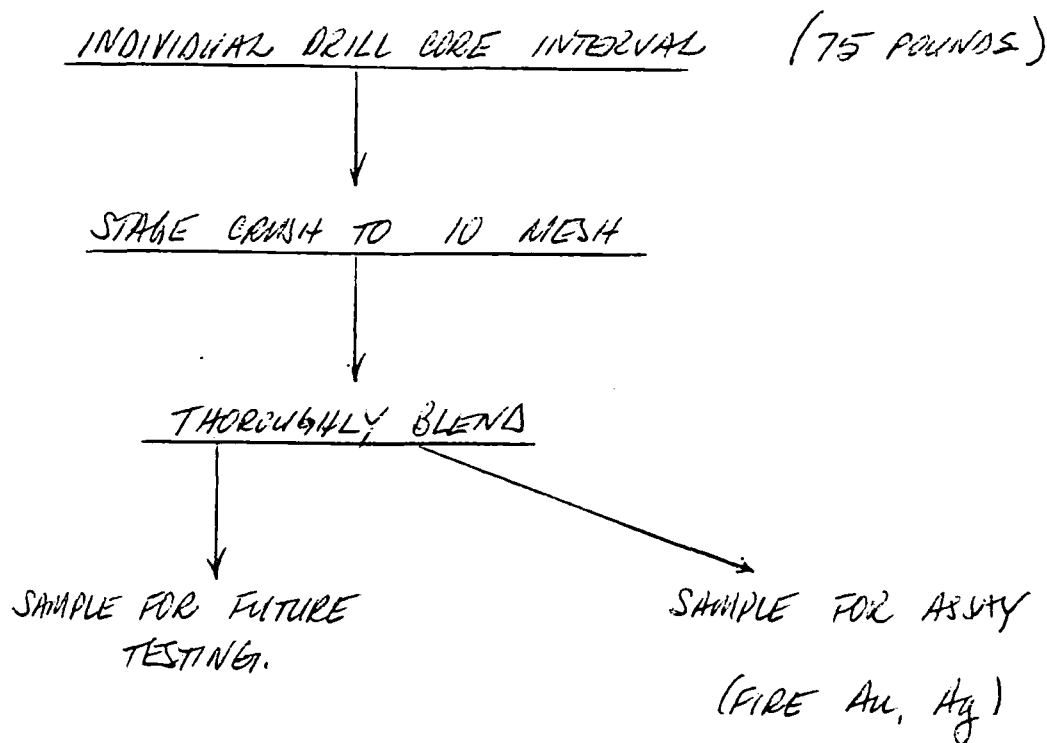
~ 8 CORE INTERVALS
~ 600 POUNDS TOTAL

FLOWSHEET 3
SAMPLE PREPARATION FOR BENCH SCALE
AND PILOT PLANT TESTING.



APPROXIMATELY 450 INDIVIDUAL SAMPLES OF 75 POUNDS EACH WILL NEED STORAGE PRIOR TO COMPOSITING.

FLWSHEET 4
SAMPLE PREPARATION FOR VARIABILITY
TESTING



APPROXIMATELY 20 INDIVIDUAL SAMPLES OF
75 POUNDS EACH WILL NEED STORAGE PRIOR
TO COMPOSITING.

METALLURGICAL TESTING

The metallurgical tests which may be required include:

SAG Mill Media Competency Test

The standard media competency test (Allis Chalmers) will be performed. (May be sub-contracted to Allis-Chalmers). Also a standard Bond Rod Mill and Ball Mill Grindability test will be conducted.

18 Inch SAG Mill Tests

The 18 inch SAG mill tests, as developed by Macpherson, will be required on 4 samples.

Bench Scale Cyanidation Tests

Bench scale cyanidation tests on a minimum of 1 kilogram will be performed. The tests will require grinding to a specified size, and perhaps a gravity concentration prior to leaching. Leaching will be monitored periodically to check reagent consumptions and interim recovery. Some leach residues will be subjected to assay screen analyses. Complete metallurgical balances of all products will be reported. Some bench scale cyanidation tests on gravity or flotation concentrates may be conducted on smaller samples.

Bench Scale Flotation Tests

Bench scale flotation tests on a minimum of 1 kilogram will be performed. The tests will require grinding to a specified size, and perhaps a gravity concentration prior to flotation. Flotation will be

monitored periodically to check interim recovery. Some flotation tailings will be subjected to assay screen analyses. Complete metallurgical balances of all products will be reported.

Large Scale Gravity Concentration Tests

It is quite possible that a large scale gravity concentration test on approximately 500 pounds of material may be needed to generate concentrates for investigation.

Pilot Plant Testing

Depending on final flowsheet the confirmation of that flowsheet may require a pilot plant demonstration. Enough sample (10 tons) to run a 250 pound per hour plant for 80 hours has been initially allocated. If run, the scope for the pilot plant would include initial set-up, operational supervision, sampling, assaying, laboratory support testwork, disposal of all products, and final clean up.

PROPOSALS

Your proposal should be received by October 24, 1989. You have been pre-qualified and proposals are expected to be contained in a brief letter addressing the requested information. You may suggest alternates for Brohm's consideration. Please submit a copy of your proposal to each of the following:

Mr. Rex Outzen, Vice President of Mining
MinVen Gold Corporation
P.O. Box 485
Deadwood, South Dakota 57732

Mr. Doug Stewart, Sulfide Project Manager
MinVen Gold Corporation
P.O. Box 485
Deadwood, South Dakota 57732

Mr. Fred Lightner
7866 S. Fairfax Ct.
Littleton, Colorado 80122

Your proposal should contain:

1. Proposed project personnel (with resumes).
2. Completed cost estimate sheet with pilot plant cost assumptions.
3. Alternates (if any).

BROHM SULFIDE PROJECT - COST ESTIMATING SHEET

ITEM	DESCRIPTION	ESTIMATED COST
1.	SAMPLE PREPARATION OF FLOWSHEET 1 INCLUDING SCREEN ANALYSIS (5 TONS SAMPLE)	-----
2.	SAMPLE PREPARATION OF FLOWSHEET 2 FOR 1 SAMPLE INCLUDING SCREEN ANALYSIS (600 POUNDS SAMPLE)	-----
3.	SAMPLE PREPARATION OF FLOWSHEET 3 FOR 1 SAMPLE INCLUDING FIRE ASSAY AND STORAGE (75 POUNDS SAMPLE)	-----
4.	SAMPLE COMPOSITING OF 10 TONS OF PILOT PLANT FEED FROM 400 SAMPLES FROM FLOWSHEET 3 INCLUDING BLENDING AND HEAD ASSAY.	-----
5.	SAG MILL MEDIA COMPETENCY TEST AS DESCRIBED	-----
6.	ONE 18 INCH SAG MILL TEST (MACPHERSON)	-----
7.	ONE BENCH SCALE CYANIDATION TEST AS DESCRIBED WITH ASSAY SCREEN ON RESIDUE (5 PRODUCTS). LEACH TIME FOR 48 HOURS WITH MONITORING @ 4,8,24,AND 36 HOURS. A GRAVITY CONCENTRATION PRIOR TO LEACH IS REQUIRED.	-----
8.	ONE BENCH SCALE FLOTATION TEST AS DESCRIBED WITH ASSAY SCREEN ON RESIDUE (5 PRODUCTS). A GRAVITY CONCENTRATION PRIOR TO FLOTATION IS REQUIRED.	-----
9.	ONE LARGE SCALE GRAVITY CONCENTRATION TEST ON A 500 POUND SAMPLE WITH A CONCENTRATE, MIDDLEING, AND TAIL AS FINAL PRODUCTS.	-----
10.	ONE PILOT PLANT RUN OF 80 HOURS ON GRAVITY CONCENTRATION FOLLOWED BY CYANIDE LEACHING. ESTIMATE SHOULD INCLUDE ALL INCLUSIVE PROGRAM AS DESCRIBED. PLEASE ATTACH YOUR ASSUMPTIONS USED FOR YOUR ESTIMATE.	-----

R88-366

145-150	.020
180-185	.020
200-205	.024
255-260	.023
265-270	.021

R88-367

570-575	.020
675-680	.020
800-805	.020
955-960	.020
1250-1255	.020

R88-371

535-540	.025
615-620	.022
665-670	.020
940-945	.024
1040-1045	.023
1105-1110	.023
1200-1205	.021

R88-377

55-60	.025
145-150	.020
215-220	.020
315-320	.020
475-480	.020
615-620	.021
670-675	.022
845-850	.021

R88-398

90-95

.020

100-105

.022

130-135

.015

★

R88-399

155-160

.020

410-415

.021

415-420

.025

445-450

.022

★

R-88-400

420-425

.024

430-435

.024

715-720

.019

760-765

.023

850-855

.020

1065-1070

.020

R88-402

265-270

.021

305-310

.020

325-330

.022

R88-403

85-90

.020

130-135

.024

145-150

.020

240-245

.022

285-290

.020

345-350

.022

475-480

.020

7. c/c
Deletion

R88-405

680-685	.020
775-780	.024
785-790	.020
855-860	.023
1005-1010	.023

R88-408

285-290	.020
300-305	.020
330-335	.025
390-395	.023
410-415	.022
415-420	.024
420-425	.023
425-430	.025
430-435	.020
515-520	.020
530-535	.022
770-775	.022
1045-1050	.021
1200-1205	.021
1265-1270	.022
1300-1305	.022

R88-409

315-320	.020
330-335	.022
535-540	.020
550-555	.022
575-580	.020
840-845	.025
855-860	.020
1150-1155	.020
1155-1160	.020

R88-411

12-15-
7-10-10

240-245	.021
245-250	.020
375-380	.024
380-385	.020
395-400	.023
700-705	.021
875-880	.022

R88-412

85-90	.021
95-100	.023
110-115	.022
275-280	.023
505-510	.022
530-535	.021
635-640	.021
940-945	.022
1070-1075	.025

★

R88-413

450-455	.020
455-460	.020
475-480	.022
500-510	.023
640-645	.023
645-650	.021
735-740	.021
740-745	.020
870-875	.022
965-970	.021

R88-416

85-90	.024
145-150	.024
250-255	.020
315-320	.022
350-355	.020
425-430	.020
535-540	.024
625-630	.023
720-725	.023
915-920	.020
1005-1010	.021
1180-1185	.023

R88-423

280-285	.023
420-425	.025
490-495	.022
505-510	.022
660-665	.021
755-760	.020

ok-get

R88-424

375-380	.024
825-830	.023
840-845	.020
915-920	
920-925	.021
1035-1040	.020
1160-1165	.020
1300-1305	.020

R88-427

925-930	.023
990-995	.020
995-1000	.023
1010-1015	.023
1185-1190	.021

R88-429

135-140	.022
175-180	.021
245-250	.020
275-280	.022
360-365	.023
365-370	.020
375-380	.020
410-415	.020

.0217 (.022)

700		
700 [#]	x .022	= 15.51
568	x .086	= 48.85
1268 [#]	.051	64.358

} All samples

527	x .059	= 31.093	- 5.25
700	x .022	= 15.51	- 11.00
1227	x .038	= 46.603	

} All samples

Bondar-Clegg, Inc.
12980 West Cedar Dr.
Lakewood, Colorado
U.S.A. 80228
Phone: (303) 989-1404
Telex: 45-693



BONDAR-CLEGG

Geochemical
Lab Report

HOLE #	INTERVAL	GRADE	LBS	GRADEX LBS
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R88-398	715-720	0.022	5.2	0.114
	745-750	0.060	5.3	0.318
	775-780	0.055	6.0	0.330

R88-402	260-265	0.046	3.0	0.138
	595-600	0.047	10.2	0.479
	605-610	0.106	6.2	0.657
	665-670	0.033	8.1	0.267
	690-695	0.458	7.3	3.343

R88-403	210-215	0.031	5.5	0.171
	225-230	0.088	7.4	0.651

R88-405	790-795	0.029	4.2	0.122
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R88-408	385-390	0.060	6.4	0.384
	570-575	0.050	4.1	0.205
	710-715	0.040	12.1	0.484

R88-409	400-405	0.031	4.7	0.146
	435-440	0.183	8.5	1.556
	555-560	0.046	4.9	0.225
	715-720	0.029	7.2	0.209
	775-780	0.044	3.9	0.172
	830-835	0.173	8.9	1.540

R88-411	330-335	0.038	1.9	0.072
	425-430	0.034	3.7	0.126
	440-445	0.122	5.0	0.610
	465-470	0.022	5.3	0.117

R88-412	140-145	0.039	3.5	0.137
	300-305	0.068	3.5	0.238
	355-360	0.046	3.7	0.170
	525-530	0.045	3.9	0.176
	805-810	0.051	4.6	0.235
	930-935	0.229	5.7	1.305

R88-415	1010-1015	0.038	6.5	0.247
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R88-416	175-180	0.043	5.1	0.219
	240-245	0.041	5.3	0.217
	790-795	0.059	8.3	0.490

R88-420	225-230	1.088	3.8	4.134
	295-300	0.030	4.3	0.129
	695-700	0.058	5.9	0.342
	750-755	0.032	7.0	0.224
	935-940	0.036	4.3	0.155

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BONDAR-CLEGG

Geochemical
Lab Report

R88-422 220-225 0.039 6.0 0.234

430-435 0.081 2.8 0.227

530-535 0.045 3.4 0.153

600-605 0.041 2.9 0.119

670-675 0.200 2.4 0.480

710-715 0.028 1.1 0.031

770-775 0.032 2.4 0.077

R88-423 435-440 0.042 6.8 0.286

515-520 0.038 7.7 0.293

590-595 0.380 7.2 2.736

R88-424 250-255 0.042 5.6 0.235

325-330 0.042 5.7 0.239

1290-1295 0.042 7.7 0.323

1385-1390 0.054 3.1 0.167

1425-1430 0.046 2.9 0.133

R88-425 385-390 0.096 11.0 1.056

R88-427 110-115 0.048 3.6 0.173

140-145 0.073 4.3 0.314

180-185 0.052 2.5 0.130

240-245 0.099 4.5 0.446

375-380 0.064 4.8 0.307

475-480 0.043 10.7 0.460

1135-1140 0.036 6.6 0.238

R88-429 45-50 0.043 4.8 0.206

145-150 0.045 4.0 0.180

295-300 0.034 3.0 0.102

405-410 0.023 2.0 0.046

470-475 0.050 3.0 0.150

670-675 0.044 9.1 0.400

755-760 0.067 8.7 0.583

R88-392 405-410 0.318 3.0 0.954

495-500 0.049 4.0 0.196

595-600 0.034 2.8 0.095

715-720 0.041 6.7 0.275

720-725 0.261 5.7 1.488

R88-368 415-420 0.056 8.3 0.465

425-430 0.036 5.9 0.212

495-500 0.028 9.3 0.260

630-635 0.043 8.2 0.353

720-725 0.217 8.7 1.888

865-870 0.052 2.6 0.135

1190-1195 0.048 9.5 0.456

1430-1435 0.064 1.8 0.115

R88-366 90-95 0.053 8.0 0.424

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195-200	0.025	9.0	0.225
310-315	0.044	8.5	0.374

R88-369	450-455	0.034	8.7	0.296
	550-555	0.024	2.4	0.058
	640-645	0.102	6.0	0.612
	810-815	0.054	2.9	0.157
	1285-1290	0.024	2.5	0.060

R88-371	505-510	0.364	7.5	2.730
	660-665	0.044	1.1	0.048
	775-780	0.087	3.9	0.339
	1070-1075	0.035	6.8	0.238
	1205-1210	0.040	4.0	0.160

R88-367	485-490	0.055	4.0	0.220
	605-610	0.045	3.5	0.158
	795-800	0.095	4.0	0.380
	1040-1045	0.040	3.3	0.132
	1200-1205	0.065	4.1	0.267
	1395-1400	0.025	2.8	0.070

R88-377	130-135	0.050	4.0	0.200
	265-270	0.035	3.9	0.137
	485-490	0.062	6.0	0.372
	555-560	0.426	6.5	2.769
	565-570	0.055	4.7	0.259
	750-755	0.032	2.9	0.093

107	568.2	49.045
-----	-------	--------

AVG GRADE	0.086
-----------	-------

100 samples / \leq .250 SAMPLES 527* - .059

$$(527 \times .059) + (\text{---} \times .0$$

527#

045

,098

.106	6.2
.183	8.5
.173	8.9
.122	5.0
.227	5.7
.200	2.4
.217	8.7
.102	6.0

.168 51.4 ~~8.648~~

9.7% of
WT.
28% of grade

$$(527 \times .059) + (\text{---} \times .025) = 30.1$$

31,093

456

983 30.1

700# * .045
.043

X





**McClelland
Laboratories, Inc.**

In Association with
H. J. Heinen
R. E. Lindstrom

1275 Kleppe Lane #4 • Sparks, NV 89431 • (702) 356-1300

October 20, 1987

Mr. Rex Outsen
BROHM MINING CORPORATION
Post Office Box 485
Deadwood, SD 57732

Dear Rex:

Enclosed is our brief report concerning analytical results obtained from cyanide detoxification work conducted on wash solutions and leached residues from Gilt Edge.

The invoice for the analytical work is enclosed also.

We wish you the best in bringing the Gilt Edge to commercial production.

Sincerely,

Gene E. McClelland
Metallurgist/General Manager

GEM:mlm
enclosure



**McClelland
Laboratories, Inc.**

In Association with
H. J. Heinen
R. E. Lindstrom

1275 Kleppe Lane #4 • Sparks, NV 89431 • (702) 356-1300

Report
on
Cyanide Detoxification Analyses - Gilt Edge
MLI Job No. 1034
October 11, 1987

for

Mr. Rex Outsen
BROHM MINING CORPORATION
Post Office Box 485
Deadwood, SD 57732

SUMMARY

A column leached residue (2" Gilt Edge feed) was washed for six days with water. Each days volume of water wash solution was used for total cyanide analysis. The washed residue was also analyzed for total cyanide.

Analytical results were very encouraging. The final wash solution (6th day) contained only 0.04 mg/l total cyanide. The washed residue contained only 0.32 mg/kg total cyanide.

Heavy metal analysis of the leached residue show that small quantities of arsenic, copper, lead, and mercury were contained in the final washed tail.

CYANIDE DETOXIFICATION PROCEDURES AND RESULTS

The leached residue (700 lbs 2" Gilt Edge feed) was washed in the leaching column with water for 6 days. Wash solution was pumped to the ore charge at a rate of 0.005 gpm/ft² of column cross-sectional area. Each days wash solution was collected and one liter was measured out for total cyanide analysis. These solutions were preserved by adjusting the pH to above 12 with sodium hydroxide. The remaining solution was sampled and titrated for free cyanide in our laboratory.

The washed leached residue was removed from the leaching column (after draining) and a sample for total cyanide and heavy metals analysis was taken immediately. The moist sample was sealed in a plastic container and was submitted for analysis.

Analytical procedures used for total cyanide content determination for solutions and solids were prescribed in EPA manual 600/4-79-020. All cyanide analyses were conducted by Sierra Environmental Monitoring in Reno, Nevada. Sierra Environmental is a licensed approved laboratory for environmental testing and analysis.

The general procedure for determining total cyanide is the same for solutions and solids. A brief description of the procedure is as follows:

1. Prepare sample for digestion (solids in slurry).
2. Digest in boiling H_2SO_4 solution.
3. Collect cyanide off gases in caustic scrubber.
4. Cyanide content read colorimetrically.

Total cyanide analytical results are provided as an appendix. Results are provided on an actual Sierra Environmental report sheet. A typographical error was seen on the original report sheet. A pen change was made for that error after confirmation by Sierra Environmental. Other hand written marks on the report sheet were made simply to identify sample type.

The washed leached residue was submitted to Rocky Mountain Geochemical laboratory for quantitative heavy metal analysis. Heavy metal analysis results are provided in table 1.

Table 1. - Heavy Metal Analysis Results, Gilt Edge Leached Residue, 2 Inch Feed

Element	Analysis	Units
Arsenic	82	mg/kg
Antimony	1.0	mg/kg
Copper	10	mg/kg
Lead	70	mg/kg
Zinc	8	mg/kg
Mercury	35	ppm
Cadmium	0	ppm
Nickel	0	ppm

Brohm Mining/Mr. Outsen
MLI Job No. 1034 - October 11, 1987

-3-

Overall analytical results show that water washing is effective in decreasing total cyanide content of solutions and tails to very low levels. Total cyanide content decreased rapidly from 0.44 to 0.04 mg/l in 6 days of water washing. The detoxification rate is shown graphically in figure 1. The curve indicates that 9 days of water washing would deplete essentially all the total cyanide.

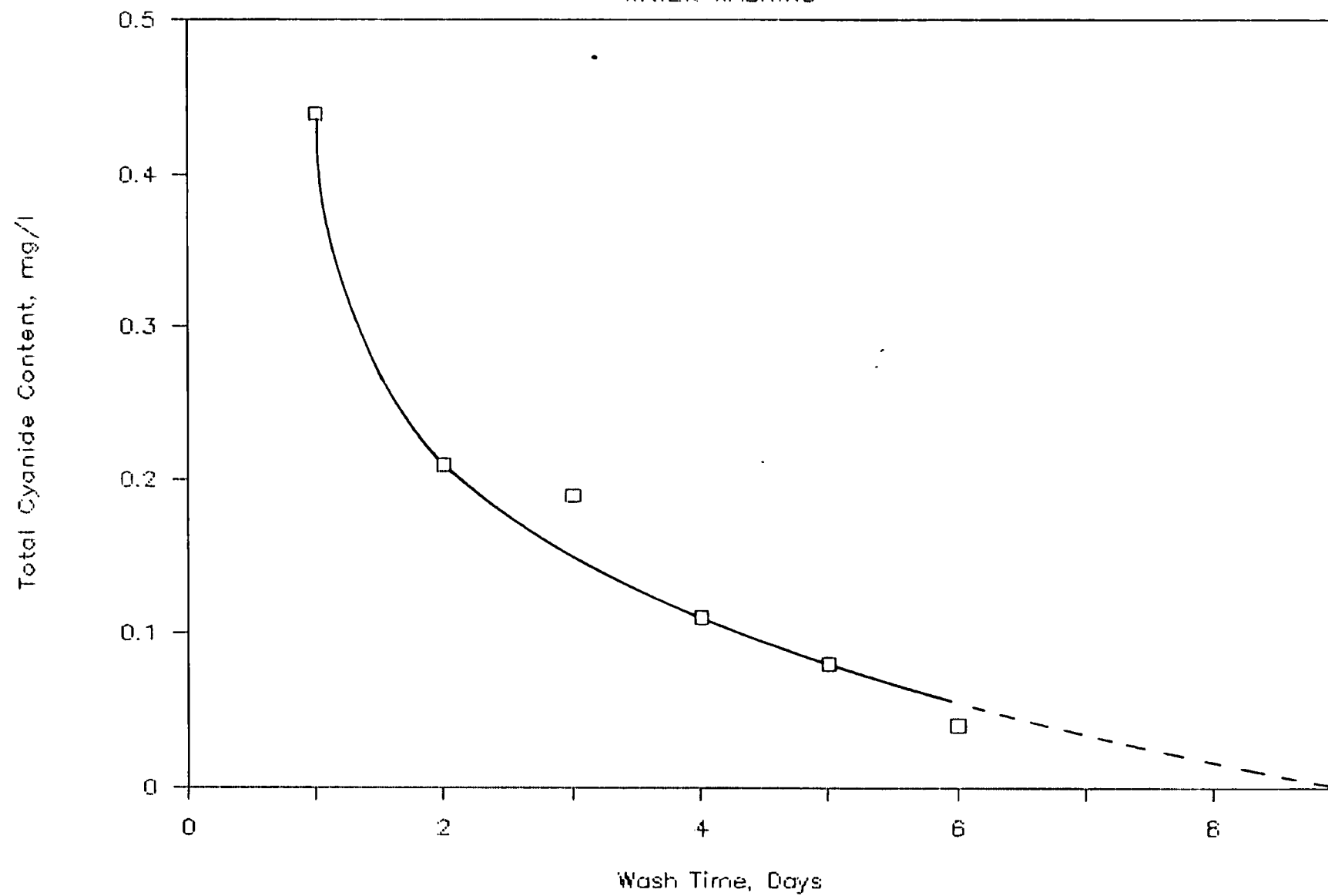
The washed leached residue contained only 0.32 mg/kg total cyanide. This low level meets disposal limits in most western states.

The washed leached residue contained small quantities of heavy metals. Arsenic, copper, lead, and mercury were heavy metals found in the largest quantity in the tail. These values are not considered high and should not be a disposal problem.



Gene E. McClelland
Metallurgist/General Manager

FIG. 1: CYANIDE DETOXIFICATION CURVE,
WATER WASHING





WATER QUALITY ANALYSIS RECORD

SAMPLES BY: Mc Clelland Laboratories
ANALYSIS BY: SEM - J. Seher

APPROVED BY:



**McClelland
LABORATORIES, Inc.**

In Association with
H. J. Heinen
R. E. Lindstrom

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**Report
on**

**Heap Leach Cyanidation Testwork on Samples
from the Gilt Edge Property
MLI Job No. 1034
July 30, 1987**

for

**Mr. Rex Outsen
Brohm Mining Corporation
P. O. Box 485
Deadwood, SD 57732**

SUMMARY

Agitated cyanidation tests were conducted on 11 drill cuttings samples (5 sulfide samples) to determine precious metals recovery, recovery rate, and reagent requirements. The sulfide cuttings samples were not amenable to direct cyanidation at a nominal 1/4" feed size. Gold recoveries ranged from 9.8 to 19.8 percent with 96 hours of cyanidation. Tail screen analysis results show that, in general, gold values are not substantially liberated even at a minus 100 mesh size. Grinding finer than minus 100 mesh would be required to liberate gold values. Cyanide consumptions were moderate to high and ranged from 0.84 to 2.83 pounds per ton of ore. Lime requirements were moderate and ranged from 5.5 to 6.8 pounds per ton of ore.

The GLE cuttings samples were readily amenable to direct cyanidation at the 1/4 inch feed size. Gold recoveries ranged from 74.2 to 96.8 percent. Cyanide consumptions were generally low from 0.25 to 0.65 pounds per ton of ore. Two of the samples were higher consumers (GLE 110 and 8) at 1.00 and 2.13 pounds per ton of ore, respectively. Lime requirements were low at 3.0 pounds per ton of ore.

Column percolation leach tests were run on a bulk sample (ROM) from Gilt Edge at various feed sizes to determine gold recovery, recovery rate, and reagent requirements, and to determine optimum heap leach feed size. The ore charges were in contact with cyanide solution for 55 days.



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July 30, 1987

Mr. Rex Outsen
Brohm Mining Corporation
P. O. Box 485
Deadwood, SD 57732

Dear Rex:

Enclosed is our report concerning metallurgical results obtained from bottle roll and column leach tests conducted on the Gilt Edge samples which you submitted.

Enclosed also is our invoice (MLI Job No. 1034) for the testwork. Our last invoice will cover costs for cyanide analytical work which we contracted to Sierra Environmental Labs.

We appreciated the opportunity to serve you on the Gilt Edge project, and wish you the best in bringing it to commercial production.

Sincerely,

Gene E. McClelland
Metallurgist/General Manager

GEM:jms

Enclosures

The Gilt Edge ore is amenable to heap leach treatment. Gold recoveries ranged 58.3 to 66.7 percent from the various feed sizes (4", 2", 3/4"). Gold recovery increased slightly with decreasing feed size. Gold extraction was substantially complete in 15 days for all three feed sizes. However, additional gold was extracted between 15 and 55 days, but at a slow rate. Initial extraction rates were more rapid as feed size decreased. Initial extraction rates were even more rapid for the agglomerated charges. The two week rest period was effective in improving extraction rate (after 35 days) and, to a slight extent, ultimate recovery. Cyanide consumptions were low and ranged from 0.35 to 0.52 pounds per ton of ore. Base requirements were low at 3.0 pounds per ton of ore.

The 2 inch unagglomerated feed was washed for seven days to determine if the free cyanide could be effectively removed from the residue. After two days of washing, the free cyanide concentration was below 25 ppm. Wash solutions and the washed residue are being analyzed for acid dissociable and free cyanide, as well as for heavy metals.

SAMPLE PREPARATION AND ANALYSES

Cuttings samples (11 total) were air dried, blended, and split to obtain samples for direct head assay and for bottle roll tests. Head samples were assayed using conventional fire assay fusion procedures. Additional samples were submitted for cyanide solubility tests to determine the quantity of cyanide soluble copper. These results are included in the appendix to this report.

The bulk sample (≈3 tons) was air dried and blended. Approximately 2,500 pounds was split out of the ROM feed (70 percent minus 4 inch) for a head screen sample and a sample for column leach test. The ROM rejects were stage crushed to 80 percent minus 2 inch and were reblended. About 200 pounds was split out for a head screen and two 700 pound charges were split out for column leach tests. The 2 inch rejects were stage crushed to 80 percent minus 3/4 inch and were reblended. Two charges of about 130 pounds each were split out for column tests and about 75 pounds was split out for a head screen analysis. About 75 pounds of the 3/4 inch feed was crushed to minus 10 mesh and was blended and split to obtain triplicate direct head assay samples and a sample for a quantitative 60 element analysis. 60 element analysis results are included in the appendix to this report.



BOTTLE ROLL TEST PROCEDURES AND RESULTS

Agitated cyanidation (bottle roll) tests were conducted on 11 drill cuttings samples, as received, to determine recovery, recovery rate, and reagent requirements. The ore charges (≈ 2 kg) were mixed with water to achieve 40 weight percent solids. The natural pH was determined for each. Lime was added to adjust the pH of the pulps to 11.0 before adding the cyanide. Sodium cyanide, equivalent to 2.0 pounds per ton of solution, was added to the alkaline pulps.

Leaching was conducted by rolling the pulps in open bottles on the laboratory rolls for 96 hours. Rolling was suspended briefly after 2, 6, 24, 48 and 72 hours to allow the pulps to settle so a sample of pregnant solution could be taken for analysis. Pregnant solution volumes were measured and sampled for precious metal analysis. The pH and cyanide concentrations were determined. Make-up water, equivalent to that withdrawn, was added to the pulps. Cyanide concentration was restored to the initial value. Lime was added, if necessary, to maintain the leaching pH at above 10.2. Rolling was then resumed.

After leaching, the pulps were filtered to separate liquids and solids. Final pregnant solution volumes were measured and sampled. The final pH and cyanide concentrations were determined. The leached residues were washed and screen assayed to determine residual precious metal content and distribution.

Overall metallurgical results from the 11 bottle roll tests are shown in Tables 1 and 2. Leach rate profiles for the GLE cuttings samples are shown in Figure 1. Tail screen analysis results are shown in Tables 3 through 13.

(Text continues on page 13.)

Table 1. - Overall Metallurgical Results, Bottle Roll Tests,
Gilt Edge Sulfide Cuttings Samples

Metallurgical Results	Sample				
	1453	1454	1455	1456	1457
Extraction: pct Total Au					
in 2 hours	6.0	0.4	3.2	1.9	1.7
in 6 hours	6.0	0.5	3.4	3.8	2.6
in 24 hours	6.7	14.2	5.6	7.7	6.8
in 48 hours	6.7	16.5	6.1	8.1	7.9
in 72 hours	10.0	17.4	7.3	8.5	7.7
in 96 hours	13.3	19.8	9.8	10.4	11.3
Extracted, oz Au/ton ore	0.002	0.019	0.004	0.005	0.006
Screened Tail, oz Au/ton ore	0.013	0.077	0.037	0.043	0.047
Calculated Head, oz Au/ton ore	0.015	0.096	0.041	0.048	0.053
Assayed Head, oz Au/ton ore	0.014	0.116	0.045	0.057	0.049
Cyanide Consumed, lb/ton ore	2.00	1.56	2.80	0.84	2.83
Lime Added, lb/ton ore	5.5	5.5	6.8	5.7	5.5
Final Solution pH	10.6	10.3	10.1	10.6	9.9
Natural Ore pH (40 pct solids)	7.9	7.4	6.9	6.8	6.9